

CLAIM LISTING

CLAIMS

We claim:

1. (Amended) A method synthesis of stable isotope labeled ester internal standards and chemical reactions for the purpose of identification and quantification of carboxylic [acid(s)] acids of the formulas R_1COOH , wherein R_1 is alkyl, aryl, or heteroatoms containing and cyclic and non-cyclic group, in a sample comprising the steps of:

a) converting authentic samples of said carboxylic acids into stable isotope labeled ester internal standards of the formulas R_1COOR_2 wherein R_1 is alkyl, aryl, or heteroatoms containing and cyclic and non-cyclic group, and R_2 is a stable isotope labeled alkyl group;

b) combining a known amount of [a] said [carboxylic acid] stable isotope labeled ester internal standards with said sample comprising said carboxylic acids ;

c) [contacting] converting said carboxylic acids in said sample mixture [with either a chloroformate and an alcohol or a base and an alkyl halide to convert said carboxylic acid in said sample] into [a] carboxylic acid esters of identical structure as [that] those of said [carboxylic acid] stable isotope labeled ester internal standards except for the stable isotope atoms;

d) [extracting] isolating said stable isotope labeled ester internal standards and said converted carboxylic acid esters in said sample by an aqueous extraction method [to isolate said carboxylic acid ester and said carboxylic acid ester internal standard]; and

e) analyzing said carboxylic acid esters and said [carboxylic acid] stable isotope labeled ester internal standards by mass spectrometry.

2. The method of claim 1 wherein said mass spectrometric method is the [isotope dilution] mass spectrometric method using stable isotope labeled ester internal standards.

3. (Canceled) The method of claim 1 wherein said carboxylic acid is a carboxylic acid having the following formula $R_1\text{COOH}$ wherein R_1 is alkyl or aryl or heteroatom containing cyclic or non-cyclic group.
4. (Canceled) The method of claim 1 wherein said carboxylic acid ester internal standard is a stable isotope labeled internal standard.
5. (Amended) The method of claim 1 wherein said [carboxylic acid] stable isotope labeled ester internal standards $R_1\text{COOR}_2$ [is] are synthesized by reacting an authentic sample of said carboxylic acids with a [stable isotope labeled reagent to form said carboxylic acid ester internal standard having the following formula $R_1\text{OCOR}_2$ wherein R_2 is a stable isotope labeled alkyl group] chloroformate and a stable isotope labeled alcohol.
6. (Amended) The method of claim 5 wherein said stable isotope labeled [alkyl group R_2 is CD_3 wherein said carboxylic acid is reacted with a chloroformate and a labeled methanol, or with a base and a labeled methyl iodide] alcohol is selected from a group comprising of stable isotope labeled methanol and ethanol.
7. (Canceled) The method of claim 5 wherein said stable isotope labeled alkyl group R_2 is CD_2CD_3 wherein said carboxylic acid is reacted with a chloroformate and a labeled ethanol, or with a base and a labeled ethyl iodide.
8. (Amended) The method of claim [5] 1 wherein said stable isotope labeled [alkyl group R_2 is $\text{CD}_2\text{C}_6\text{D}_5$ wherein said carboxylic acid is reacted with a base and a labeled benzyl chloride] ester internal standards are synthesized by reacting an authentic sample of said carboxylic acids with a base and a stable isotope labeled alkyl halide.

9. (Amended) The method of claim 1 wherein said aqueous extraction step [c] d) can be any appropriate separating method[s] such as solid phase extraction, liquid-liquid extraction or solid supported liquid-liquid extraction method.
10. (Canceled) The method of claim 1 wherein said alcohol is selected from a group consisting of methanol and ethanol.
11. (Amended) The method of claim [1] 5 wherein said chloroformate is selected from a group [consisting] comprising of isobutyl chloroformate, methyl chloroformate, and ethyl chloroformate.
12. (Amended) The method of claim [1] 8 wherein said stable isotope labeled alkyl halide is selected from a group [consisting] comprising of stable isotope labeled methyl iodide, ethyl iodide, and benzyl chloride.
13. (Amended) The method of claim [1] 8 wherein said base is selected from a group [consisting] comprising of sodium hydroxide, sodium carbonate, pyridine and triethylamine.
14. (Amended) The method of claim 1 wherein [said sample contains either a singularity or a plurality of] said carboxylic acids in said sample mixture are converted to said carboxylic acid esters of identical structure as those of the stable isotope labeled internal standards except the stable isotope atoms by reacting said sample with a chloroformate and an alcohol.
15. (Amended) The method of claim 1 wherein said [multiple] carboxylic acids in said sample mixture are [can be] converted to said [multiple] carboxylic acid esters of identical structure as those of the stable isotope labeled internal standards except the stable isotope atoms by reacting said sample with [using either a chloroformate and a single alcohol or] a base and [a single] an alkyl halide.

16. (Canceled) The method of claim 1 wherein said multiple carboxylic acid ester internal standards can be synthesized using either a chloroformate and a single labeled alcohol or a base and a single labeled alkyl halide.
17. (Amended) The method of claim 1 wherein there is no conversion of said stable isotope labeled carboxylic acid ester internal standard to its corresponding non-labeled carboxylic acid ester compound during step [b] c).
18. (Amended) The method of claim 1 wherein said converting step [b] c) is performed in an aqueous environment.
19. (Amended) The method of claim 1 wherein said converting step [b] c) is performed before said extraction step d).
20. (Amended) The method of claim 1 wherein said converting step [b] c) is quantitative.
21. (New) The method of claim 14 wherein said chloroformate is selected from a group comprising of isobutyl chloroformate, methyl chloroformate, and ethyl chloroformate.
22. (New) The method of claim 14 wherein said alcohol is selected from a group comprising of methanol and ethanol.
23. (New) The method of claim 15 wherein said base is selected from a group comprising of sodium hydroxide, sodium carbonate, pyridine and triethylamine.
24. (New) The method of claim 15 wherein said alkyl halide is selected from a group comprising of methyl iodide, ethyl iodide, and benzyl chloride.